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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:
Richard Dias

Examiner: Popovics, Robert J.

Serial No.: **09/822,898**
Date Filed: **March 30, 2001**

Art Unit: 1724
Atty. Docket No. 024009-0276266

For: **Sloped Screen Separator That Removes Solids From A Manure Slurry**

CERTIFICATE OF MAILING

I hereby certify that this paper (along with all papers referred to as being attached or enclosed) is being deposited with the U.S. Postal Service, postage prepaid, to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA on the date indicated below.

Date: September 17, 2003

By: Deanna Costen
Deanna Costen

DECLARATION OF RICHARD DIAS UNDER 37 C.F.R. § 1.132

[COPY: FOR PURPOSES OF READABILITY]

Box: **Non-Fee Amendment**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

I hereby declare that:

1. I am the sole inventor of the claimed invention in the above-identified application.

2. I have been the owner and operator of a cattle dairy and crop farm (e.g., wheat, etc.) in or around Kingsburg, California, for over 25 years.

3. Based on my experience as a dairy operator and on information and belief, prior to the claimed invention in the above-identified application, the typical manure slurry gravity-fed screen separator was no more than about 20% efficient at removing solids from the slurry.

4. For several years leading up to the filing of the above-identified application, I experimented with numerous gravity-fed screen separator designs, systematically altering different parameters (e.g., screen types, hole sizes, slopes, vacuums, water spray, etc.), with a goal of improving their efficiency.

5. As a result of my continued experimentation, I discovered the various aspects of the claimed invention of the above-identified application, including the particular combinations of screen size and slope, water spray location and volume, and vacuum as claimed.

6. Based on my experience as a dairy operator and my use of the claimed invention in the above-identified application, the claimed manure slurry gravity-fed screen separator is dramatically more efficient at removing solids from the slurry than prior, commercially-available designs.

7. With my approval, beginning on or about April 2001, Dr. Brion Duffy of the United State Department of Agriculture (USDA), Food Safety and Health Research Unit, from Albany, CA visited my dairy farm to inspect, measure and analyze the improvements of an implementation of my invention as claimed in the above-identified application.

8. I have read and understand the results for Dr. Duffy's inspections, measurements and analyses, which are attached hereto as Exhibit A.

9. Based on my understanding of Dr. Duffy's results as shown in Exhibit A, the total solids-removed efficiency of the claimed invention is in excess of 80% after the first screening of the dual-screening process, and in excess of 90% after the second screening.

10. Further, based on my working experience with the claimed invention in the above-identified application, the efficiency in total solids-removed has significantly reduced the frequency with which I must have unscreened slurry pumped from my waste lagoons.

11. Based on my experience as a farmer using the separated manure-slurry solids as fertilizer, prior to the claimed invention in the above-identified application, I supplemented the fertilizer solids with externally introduced nitrogen to increase the nitrogen levels to appropriate nutrient levels.

12. Further, based on my working experience with the claimed invention in the above-identified

application and as confirmed by my understanding of Dr. Duffy's results as shown in Exhibit A, the nitrogen content of the separated solids that result from use of the claimed invention, when used as fertilizer for farming, has increased to levels that no longer require supplementation with externally introduced nitrogen.

13. Further, I have read and understand the article, attached hereto as Exhibit B, entitled, "Evaluating the claims", by Deanne Meyer of the University of California, Davis, published in Western Dairy Business in February 2003, which points out that, "one is hard pressed to find economically feasible technology available today [i.e., when the article was written in late 2002] that will consistently remove more than 60% of solids." (Exhibit B, p.24, col. 2, ll. 14-18).

14. Additionally, based on my experience using the claimed invention in the above-identified application, the above enumerated advantages of the specific combinations of design constraints as claimed have been obtained with no substantial detriment to capacity (i.e., the total volume of manure slurry per given timeframe capable of being separated), and with no substantial increase to life cycle cost (i.e., cost of acquisition plus cost of operation and maintenance, etc.).

15. I further declare that all statements made herein of my knowledge are true and all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statement and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statement may jeopardize the validity of the application or any patents that might issue from them.

Signed, the _____ day of August, 2003; ________________________________.

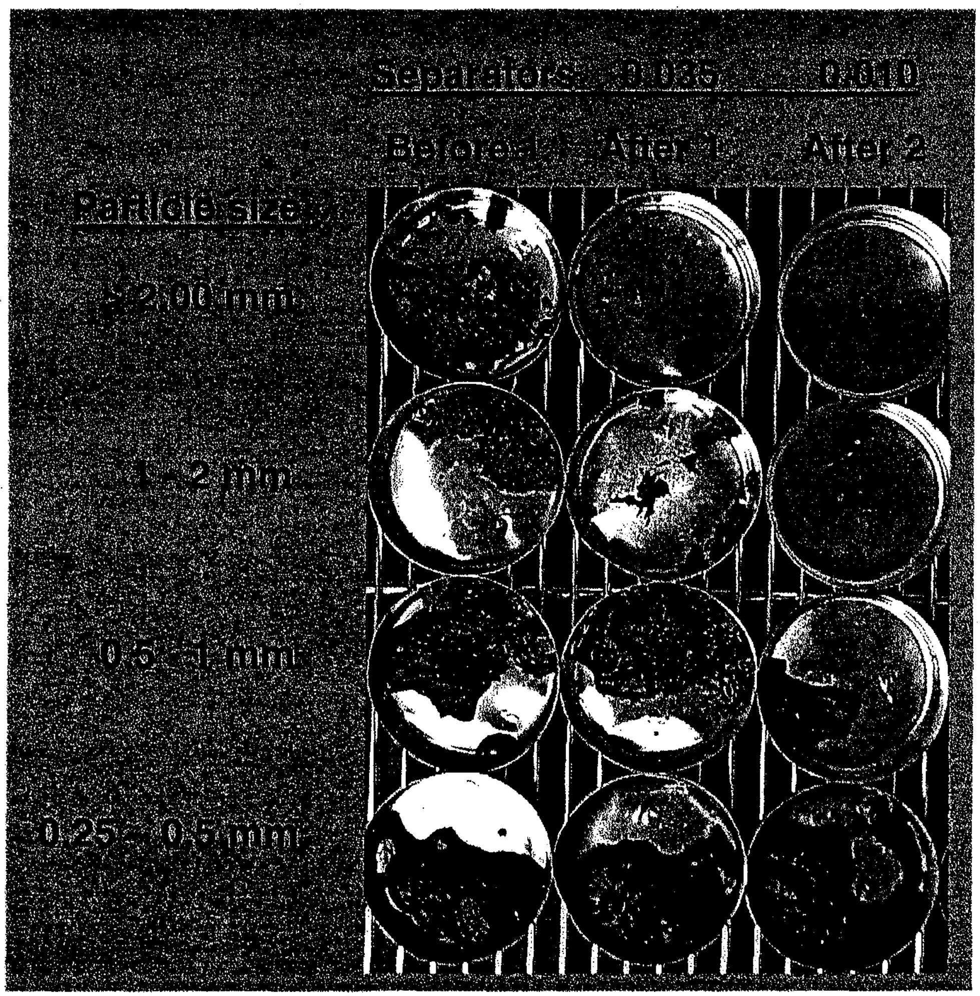
By: Richard Dias

Attachments:

Exhibits A-B

Dias Declaration, Exhibit A

Manure Solids Removal Using Dual-Separator System Developed by R. Dias



USDA ARS
United States Department of Agriculture
Agricultural Research Service
Food Safety and Health Research Unit
Albany, CA 94710

Solids Removed with the First 0.035 Mesh Separator.
Numbers represent grams dry weight in 8 L of flush water, or percent reduction.

Particle size	Before 0.035	After 0.035	Reduction (%)
>2.0 mm	44.47	0.21	99.52
1.0-2.0 mm	4.41	2.18	50.54
0.5-1 mm	2.84	4.60	-61.86
0.25-0.5 mm	2.80	3.44	-23.14
Total	54.52	10.43	80.85

Nearly all of the very largest particles are removed with the first separator.
This is the bulk of the solids. Smaller particles are not captured with this screen.

Solids removal with 0.035 and 0.010 mesh dual separators.

Numbers represent grams dry weight in 8 liters of flush water, or percent reduction.

Particle size	Before 0.035	After 0.010	Reduction (%)
>2.0 mm	44.47	0.01	99.97
1.0-2.0 mm	4.41	0.02	99.48
0.5-1 mm	2.84	0.97	65.90
0.25-0.5 mm	2.80	2.63	6.04
Total	54.52	3.63	93.35

With a second screen of smaller mesh size, now almost all of the particles above 1 mm diameter are captured. Furthermore, now a large portion of smaller particles (>0.5 mm diameter) are also removed. Still the very smallest sediment-sized particles pass through.

Solids removal with 0.035 and 0.008 mesh dual separators.

Numbers represent grams dry weight in 8 liters of flush water, or percent reduction.

Particle size	Before 0.035	After 0.008	Reduction (%)
>2.0 mm	41.24	0	100
1.0-2.0 mm	5.41	0	100
0.5-1 mm	3.73	0.04	98.83
0.25-0.5 mm	3.91	1.28	67.25
Total	54.29	1.32	97.56

After replacing the second screen with an even smaller mesh, almost everything but the sediment sized particles are captured. And even now over 67% of this fraction is being removed from the system.

Chemical analysis for samples taken at Dias dairy on *May 25, 2001.*

NOTE: Water quality remains same from the flush through to the irrigation lagoon. Most of the nutrients are removed with the manure solids.

Numbers represent parts per million (milligrams per kilo or liter), a ratio of C:N, % organic matter.

	Tot N	NH-N	NO-N	P	K	S	Mg	Ca
Flush water	218.5	200	<.5	49	259	10	89	86
Fresh manure	4679	35.4	26.5	1150	703	505	1292	2945
Lane wash	1281.6	696.4	4.8	203	938	99	269	508
Manure sep 1	2393	29.9	3.4	465	638	417	606	1744
Manure sep 2	3029	14.8	3.1	439	848	524	571	1918
Outflow sep 1	355.6	318.5	2.1	81	435	31	127	207
Outflow sep 2	418.6	303.7	1.2	89	471	31	131	219
Lagoon 1	307.4	244.5	<.5	61	334	11	98	153
Lagoon 2	222.2	177.8	<.5	46	234	10	80	82

	Na	Fe	Al	Mn	Cu	Zn	C:N	OM
Flush water	52	1.3	<1	0.3	0.2	0.2	3:1	0.11
Fresh manure	152	115	62	36	5	29	16:1	86.03
Lane wash	151	46	22	5.7	1	4.2	6:1	1.24
Manure sep 1	123	224	92	21	14	13	44:1	88.47
Manure sep 2	138	308	110	22	17	19	7:1	84.76
Outflow sep 1	82	15.7	5.1	1.8	1.8	1.2	29:1	0.41
Outflow sep 2	89	13.8	6.1	2	1.6	1.3	6:1	0.43
Lagoon 1	66	10	5.1	0.9	0.5	0.6	4:1	0.19
Lagoon 2	46	1.6	0.6	0.3	0.1	0.2	3:1	0.1

Element names:

Tot N	Total nitrogen
NH-N	Ammonia nitrogen
NO-N	Nitrate nitrogen
P	Phosphorus
K	Potassium
S	Sulfur
Mg	Magnesium
Ca	Calcium
Na	Sodium
Fe	Iron
Al	Aluminum
Mn	Manganese
Cu	Copper
Zn	Zinc
C:N	Carbon to nitrogen ratio
OM	Organic matter percent

Dias Declaration, Exhibit B

Evaluating the claims

■ How do you pick the right technology for your manure management system? Do your homework!

by Deanne Meyer

Everyone who reads magazines or attends equipment shows is bombarded with marketing claims on the efficacy of animal waste management systems. How do you verify or test the technology to determine if it does what it claims? How do you know which ones to believe? Will the technology or product help you be in compliance with local, state or federal regulations? Let's look at these questions one at a time.

T sting the technology

Each employee on the dairy has specific job requirements and expectations. Investments in technology parallel employee expectations. What is it you expect the technology to accomplish? How does the old adage go — "if you don't know where you're going any road will get you there." Well the same is true for technologies.

Define the job description — write down what your expectations are. Then define your method to do a proper and thorough performance evaluation. Be sure that the information obtained during the performance evaluation will address the objectives of the technology. Determine appropriate records to maintain to be used to determine the effectiveness of the technology.

Begin the technology evaluation process. Keep records of regular activities that potentially impact the ability of the technology to work.

As an example, if you are installing a solid-liquid separation device for the purpose of removing large particles, you will want to evaluate the size of the remaining particles that are in the liquid separated by the technology. Maybe you could simply use a fine screen and compare how much remains on your fine screen before installation and after installation. However, if the objective of the separation is to remove nutrients, then testing the liquid for particle size isn't important. What is important is a comparison between the nutrient content of water entering the separator versus that leaving the separator. The number of and frequency of samples taken will depend on the design and management of the dairy. In fact, you may want to sample on different days at different times. You may need to also sample the water used to flush the lanes (if it is recycled from the pond). If you flush lanes in 20 seconds then you might need to take one, two or three samples. If it takes seven to 15 minutes per lane you might need to sample at 20, 30 or 40 second intervals during the first few minutes and then at one-minute increments thereafter. Every facility is designed and managed differently so it should be no surprise that we don't have a standard testing protocol.

The kind of evaluation will be different if you want to change particle size, nutrient content or evaluate air emissions. What is critical is that your sampling or monitoring program be sufficient to provide you with information to evaluate job performance.

Evaluating the claims

Which ones should you believe?

Composting equals CAFO compliance. There is no requirement in the current Federal Regulations or the proposed amendments to these regulations that would require composting. Certainly, if you compost you will reduce the volume of material remaining. This means reduced truck loads of manure to haul (a benefit if you are transporting solid manure any distance).

However, ***the final product will have higher salt and phosphorus concentrations*** than the original starting material. Why? — Because you've changed the total volume of material but not the volume of salt and phosphorus, therefore, your concentration of salt and phosphorus will be higher.

Odor can be reduced if composting is done properly and if the primary route of solid manure storage causes an odor. Pathogens and weed seeds can be killed when the composting conditions are correct. One big challenge is that the reduced volume from the compost material has resulted in gaseous emissions. Since composting is done in the presence of air, methane shouldn't be formed. However, ammonia and other gaseous emissions will occur. In areas where particulate matter is an issue, ammonia emissions can be a problem with air regulatory agencies (it can contribute to small particulates when it binds with exhaust from combustion engines). In the Chino Basin there is discussion that all composting facilities may need to be enclosed in buildings. In short, while composting is an effective means to reduce the volume of solid manure, ammonia emissions do occur and the dust created in the turning process can be substantial and undesirable.

Complete solids separation. Manure consists of fiber, protein, undigested feedstuffs, products of metabolism and minerals. All of these components

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FYI

■ **Deanne Meyer is a waste management specialist with the University of California, Davis. She has spent years studying manure management system technologies and the regulatory rules associated with dairy manure management. She can be reached at (530) 752-9391, or by e-mail at: dmeyer@ucdavis.edu.**

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add to the solids content. Most separators are trying to separate solids (manure and bedding) from a liquid waste stream. Although there are technologies that can be put in sequence to theoretically remove all the solids from a liquid waste stream, it is still not economically viable. Particle size and density effect the potential removal of solids. Salts are soluble and remain in liquid.

The benefit of salt removal in solids is associated with the water content of the solids. If technologies have been tested, be sure they have been tested at different times during the day and over different seasons. A higher percent of solids can be removed if more bedding is used or if more manure is collected. Separator technology can be effective at removing a small or mediocre amount of solids. Identify your reason for selecting a particular technology and be sure to evaluate the technology performance.

High percent removal of solids. The standard method to describe separation efficiency by agricultural engineers is to describe the percent of total solids removed. Imagine that you put four tablespoons of salt in a gallon of water. How much of this salt would you expect to recover if you ran it over a screen? Depending on the types of feed ingredients fed to cows and their level of production, it is quite possible that one-half of the solids in manure are smaller than 250 microns (254 microns is 10/1000 of an inch). Depending on the type of bedding and the amount of bedding, the relationship of larger (bigger than 250 microns) particles versus smaller particles can vary considerably. One is hard pressed to find economically feasible technology available today that will consistently remove more than 60 percent of solids. ***Just because solids are removed, does not mean salts or phosphorus are removed at the same rate.*** Removal of solids does not translate to similar removal of nutrients.

Meeting agronomic rates. Sampling of the liquid manure that is to be land applied and then targeting nutrient applications based on the nutrient values are necessary components of calculating or meeting "land applied agronomic rates." It is the sampling of the material and the use of the results that enables the application at agronomic rates. ***Manure slurry from the bottom of retention ponds can be nutrient rich.*** If it is, this material must be diluted significantly before application in order to be applied at agronomic rates.

Improves nitrogen phosphorus ratios. Typically, the nitrogen in anaerobic ponds is in two different forms: ***organic and ammonium.*** Nitrogen in the ***ammonium*** form can be volatilized to the air. When land applied, it can be volatilized or it can be used by plants. If it remains in the soil, it can be converted to ***nitrate*** and consumed by plants or leached. To improve the nitrogen phosphorus ratio implies that there will be more nitrogen or less phosphorus. Practices to conserve plant available nitrogen include frequent collection of urine and pond management to minimize ammonia volatilization and increase mineralization of organic nitrogen. Chemical flocculants can be used to bind phosphorus and render it unavailable.

University tested and proven. Researchers at universities may conduct research on technologies or products in the field (on farm) or in laboratories. Be sure the claims made match

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the project done (were measurements actually made?). Depending on the technology evaluated, check to be sure it was tested at different times and different seasons. Also, you will want to fully understand the results. Sometimes results indicate that the product is not effective and yet an advertisement is not incorrect to say it was tested. University tests neither prove nor endorse products. Producers should carefully review protocols and data to be sure claims were evaluated and conclusions drawn are appropriate for the work done.

Meeting Regulatory Compliance Requirements. Who doesn't want a silver bullet, or just knowing that if you purchase something that it will please your local, state or federal regulators? Realize that regulators just regulate. They do not impose specific management practices at this point. That said, we don't have technologies that make someone in compliance with water regulations. There may be consulting services (plan development) that will assist or document that a person is in compliance. Currently, there are NO required technologies in the western states.

When regulations are promulgated to reduce nutrient discharge or application to land, or reduce air emissions, regulatory agencies will define the criteria and it will be up to producers to determine how to meet the criteria.

For example, if a dairy needs to reduce accumulation of a phosphorus, this may be done (depending on the situation) with dietary manipulation, relocating young stock, decreasing herd size, or increasing land base available for manure application. Additionally, use of chemical products to precipitate the phosphorus may be economically viable.

Comprehensive Nutrient Management Plans

Each state is developing guidance for CNMP's. Some states are well into the process. Other states like California aren't quite there yet. States will need to determine if individuals need to be certified to prepare CNMP's and identify the requirements of the certification. Individuals and companies can prepare nutrient management plans in California. These are not defined. Merced County has a Merced County CNMP. The county CNMP will be changed to the state CNMP when the statewide guidance becomes available.

Many people will be marketing their skills to dairy operators indicating they can fulfill permitting requirements. Act wisely and check credentials of people before you hire them. Check with the regulatory agency, your local cooperative extension advisor or agent, or your trade association to see how the person or company's track record is with the agency staff. Consult with your trade association or your milk processor or cooperative. A little investigation on references up front can save a lot of time and money later on.

It is very important to request information and follow-up. Purchasing products, materials, or services can be expensive and particularly frustrating if they don't work out well. Be sure to do your homework ahead of time to determine if a technology is appropriate or not. Identify the purpose (job description) of using a technology before you purchase it. ■